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ABSTRACT

A broad spectrum of activities designed to enhance learning through the use of outdoor (natural) media is presented in this document for the sciences, language arts, and social sciences. Activities are primarily for the upper elementary grades, but adaptions and provisions are made for the primary and secondary levels. Also included is a teacher's activity form to aid in the planning and evaluation of outdoor activities. Funds for preparation of this guide were provided by the Elementary and Secondary Education Act (Title III). (DK)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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# LESSONS IN DISCOVERY

## An Invitation to Innovation

Program of Outdoor Education
827 Fort Hall Avenue
American Falls, Idaho 83211

RC 002 502

# INTRODUCTION

.....At a banquet honoring Columbus, one of the guests took Chris to task for the importance of the discovery of the new land, He said, "What is so great or difficult about your discovery? You just set sail and kept sailing, surely this isn't difficult to do." To this Columbus took an egg that was being served at the banquet and asked his critic to stand it on end. The person tried and tried to do this but to no avail. In exasperation he turned to Columbus and said, "It can't be done!" Columbus took the egg from the man and squashed it slightly at one end and there it stood on end. The other man exclaimed, "It is easy when you do it like that." Columbus replied, putting the man in his place, "Anything is easy if you know how to do it." .....

The following activities are offered only to free both teachers and students to open up to opportunities for learning, opportunities that pervade the out-of-doors.

We sincerely hope that these experiences will lead you to develop for yourselves new and exciting extended learning activities which may be shared with others.

Harry Shimada, Jr.
Director, Outdoor Education

# Suggested Activities for Science

## SCIENCE

Make a scientific study ring by shaping a wire clothes hanger into a circle. To make a plant analysis of a lawn or field, randomly throw the study ring twenty times and keep a record on a chart of how many times a particular plant occurs inside the ring. Make a sketch of each plant chosen for study. (Math activity-determine the percentage that a plant is found inside the ring. For example, if a chosen plant occurs inside the ring during ten of twenty tosses, its distribution covers approximately 50% of the area.)

Examine soil under a microscope. Distinguish between mineral and organic particles. Rub samples of different soil types between your fingers. What does it indicate.?

Punch small holes in the bottom of five tin cans of equal size. Fill with different kinds of soil; clay, sand, gravel, etc. Place a jar under each can. Pour equal amounts of water into each can, and note how much water has drained. Seek explanation (water absorption.)

Fill two glass jars with different types of soil; one loose, one compacted. Drop one or two earthworms into each. Explain the earthworm as soil builder.

Find an area that has gullies and eroded slopes. Seek explanation of erosion, and methods to correct it.

Visit a recently cut forest area. Check for new growth. Are there signs of erosion? Was care used in removing timber? What provision is there for fire protection?

Visit a burned woodland-find out cause of fire. Review what was destroyed by fire (values for wildlife, streamflow, topsoil fertility) How long will it take to restore these values?

Visit a pasture or natural range used by livestock. Find out what plants are growing. Check to see if the area has been too heavily grazed. Questions to ask - What evidence of rodents is there? What damage, if any, to the area? What would increase production of forage?

Follow up Activities

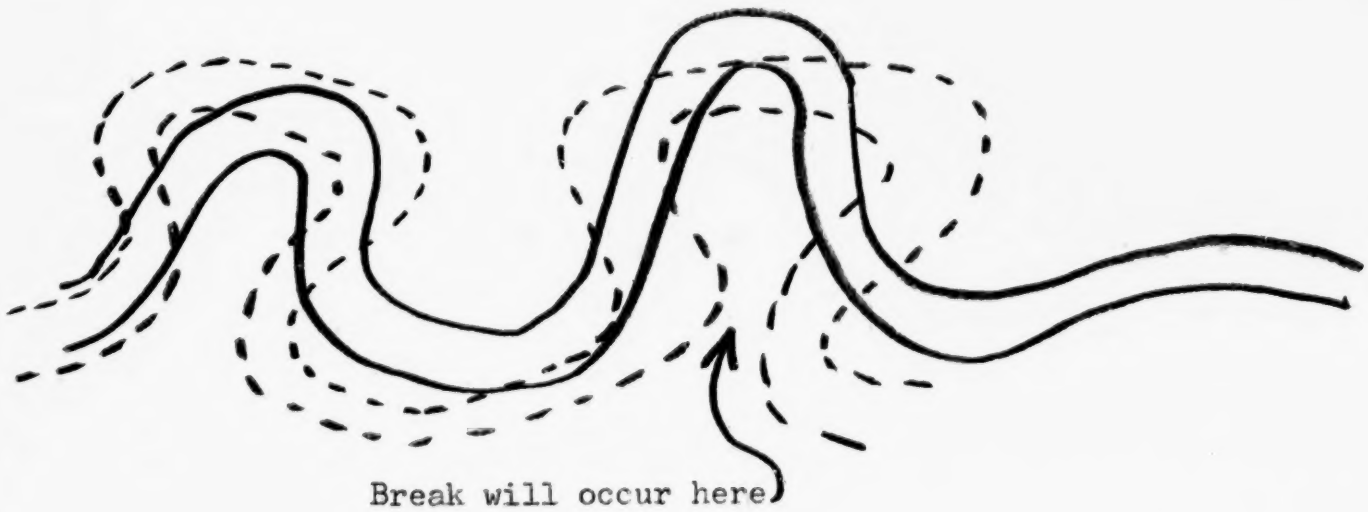
1. Make some soil artificially.
2. Make posters on conservation.
3. Keep some small animals for a short time to watch their feeding and living habits.
4. Plant trees; check with the U.S. Forest Service for advice and assistance on the best trees to plant and how to get seedlings.
5. Visit a sawmill, or lumber yard to find out the source of the raw material, how the wood is sawed and processed. What species are represented? How is seasoning accomplished? What products are sold? What conservation practices are used for by-products or waste?

# GULLIES

When raindrops fall on land surface, the water which is not absorbed into the ground quickly gathers together and forms a tiny stream. Small streams join up to form a larger body of water. As the joined bodies of water move from areas of higher elevation toward areas of lower elevation, the water gnaws away the banks on each side, as well as the bed over which it flows with great speed and force. The speed and force of the moving water are of themselves enough to wear away the banks which are composed of soft rock (limestone and sandstone), but the moving water is also armed with stones, pebbles and sand. The larger pieces of rock are rolled along its bed and are pounded against one another, so that they are worn quickly into rounded pebbles and boulders and sand. The bed is also worn away in the process until little is left except bedrock.

The water in the gully swings from side to side so that the eroding effect is greatest on the concave sides. Small cliffs are formed, and undercutting of the cliffs results in rock falls. In this way the gully develops curves, or meanders, as it swings from side to side. As it swings from side to side the water begins to whirl round and round, and the suspended rock causes further erosive action to take place on both soil and rock. When the moving water slows down large stone particles are dropped, whereas smaller pebbles and sand are carried further downstream. As the water slows down even more, the pebbles are dropped and sand particles only remain. Sand remains suspended in the water and moves with the stream until some obstacle stops the flow and then the particles are deposited. This sand deposit is usually made on the convex side of the meander.

The diagram below demonstrates how water in a gully meanders and causes erosive action, which leads to further meandering.




_____ present gully bed

---------- anticipated gully bed resulting from meandering

# CLUE CHART FOR BIRD IDENTIFICATION

SIZE SHADE SHAPE SURROUNDING SWEEP SONG

## Bird Characteristics

Size - Is the bird larger than a sparrow (6 inches)? or a robin (10 inches)? or a crow (20 inches)?

Shade - Areas of the body where colors are located (variations in color at the throat, belly, wings, tail, and markings of feathers)

Shape - a. body shape (plump, sleek, thin, short and stubby, or streamlined)
b. head and bill shape (bill is thick or thin or long or short)
c. tail shape (rounded, wedge, square, notched)
d. wing shape (rounded, pointed, ragged)
e. leg snape (long or short)

Surrounding - Where was the bird located? (tree top, vertical position on tree trunk, in a wooded area, meadow, telephone wire, fence post, prairie, along the country road, swimming or floating on water, other)

Sweep - What were the flight characteristics? (jerky, darting, swooping, irregular flight)

Song - Are there phonetic sounds such as "raspy, chip-chip, peter-peter?" or a trill?

# CLUE CHART FOR THE IDENTIFICATION OF TREES

| LEAVES | BARK | BRANCHING | FRUIT | FLOWERS | OTHER |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## SOME DESCRIPTIVE CLUES

Leaves - 2 kinds of needles, alternate and compound, usually 5 to 7 leaflets 8 to 12 inches long, simple and alternate, opposite, deeply lobed, smooth on top side and rough on bottom side, etc.

Bark - separates into thick plates, has scale-like or warty projections of dead bark, dark gray and divided into irregular flat-topped thick ridges, etc.

Branching - opposite, alternate, has spines growing in clusters

Fruit - acorn about ½ inch in length, has leafy bracts 1 to 2 inches long, nut has a thick shell which is light green, nut is enclosed in an oblong yellowish-green husk about 2 inches long, etc.

Flowers - has yellowish-green drooping catkins, is 2 to 3 inches long and has 6 upright petals which are whitish-green tinged with yellow, greenish-yellow and taste like honey, flowers are fragrant and are arranged like a pendant, etc.

Other - height, shape (fan-shaped), hardwood, softwood, etc.

# A LEAF....AN EXERCISE IN THE DISCOVERY APPROACH

(This exercise may help in leading students to discover and explore some understandings about resources and their interrelationships.)

## List Some Things We know About This Leaf

(Hold up leaf in front of group and ask them to list briefly things they know about it)

1. Part of a tree
2. Manufactures food--converts sun's energy into plant growth
3. Provides food for animals
4. Provides food for plants
5. Turns color in fall
6. Drops from tree
7. Decomposes
8. Has texture, certain shape and size
9. Shade for people, animals, other plants
10. It's beautiful
11. Protects soil from raindrops hitting the ground too hard
12. Moves in the breeze

## Activities With This Leaf

(Ask the class: What can we do with this leaf?)

1. Relate leaf to whole of tree
2. Explore function of leaf
3. Make herbarium of leaves
4. Make collection of leaf skeletions
5. Study humus and decide what it is
6. Spelling or tree names and shapes of leaves
7. Art--shapes, texture, colors
8. Research - why change colors?
   - why shaped like they are?
10. What kind of leaf is it?
11. Write short stories about the tree
12. Adopt the tree
13. What kind of music does this leaf make?
14. Did this tree have a history, has it affected our history?
15. How did the leaf develop?
16. Where does this tree grow naturally and why?
17. How big an area do all the leaves on this tree cover?

## Some Attitudes and Sensitivities to be Learned

1. Appreciate value of leaf and its relation to its function, to the tree, to soil, man, animals other plants, and its environoment.
2. Esthetic beauty of resources, such as trees.
3. Economic value of resources.
4. Students become involved in critical analysis and would be more curious about nature and things about them. (Leaf is no longer just a leaf.)
5. Accomplish objectives of learning in the basic curriculum by making it meaningful and giving it a practical use.
6. Relation to other subjects:
   wordpower
   reading comprehension
   art appreciation
   world around us
   oral presentation
   creative writing
   discovering things for themselves.
7. The teacher may stress that the known items and activities discovered by the students are related to natural resources and affect each one of us directly or indirectly.

(Note: An exercise involving a simple thing such as a leaf, a rock, a fossil, a piece of wood, or a picture can lead to new meanings about the out-of-doors and conservation resources through discovery.)

From - Conservation Vistas, Dec. 1964

# WOOD CARVINGS

**Materials:**

White pine, basswood, aspen, and sumac are relatively good for beginners because they are soft. Apple, cherry, walnut, osage orange, red cedar, and hickory are a little more difficult but make beautiful carvings.

**Tools:**

In making simple carvings a knife is usually the only necessary tool except for a whet stone. More difficult carvings may require wood chisels or other working tools.

**Directions:**

1. Decide upon an object to carve.
2. Choose a piece of wood the correct size and type in order to conserve materials and reduce the amount of carving.
3. Draw or sketch the outline of the object on the wood.
4. Begin with a sharp knife.
5. Rough carve around the outline.
6. Cut away from you as much as possible.
7. The "finish" carving should be carefully and slowly done, to prevent splitting and chipping of the wood.
8. Sand or leave carving marks as desired.
9. Apply linseed oil, stain or leave untreated to obtain desired finish.

**Objects for beginners:**

Letter opener, outline animals, ash tray, and others.

**Objects for advanced carvers:**

Complete animals, beach clogs, totem poles, and others.

# "FINGERPRINTING" A TREE

## STUMP

Find a tree stump that has been sawed fairly smooth by a hand saw, not a chain saw. Stretch a narrow strip of paper (adding machine paper is fine) across the top over the center, turn the ends over the edge of the stump, and fasten with thumb tacks. Rub the flat of a soft pencil or crayon across the rings. If the cut was fairly smooth the yearly growth rings should come out clearly. It is easier to count the rings if you will mark with pins every 10th ring, starting from the outer edge, before removing the paper.

You can find out lots more about the tree by studying the stump. The narrow rings represent dry years. Some rings may be uneven, the widest part usually appearing on the sunny side of the tree. Can you tell if this is so with your stump? Scars, too, are left by disease and fire damage. Can you tell what kind of tree it was (look at the bark, if any is left), or how long ago it was felled? The age of the stump sprouts will help you here. Count the bud scale rings on them as you did with a twig (see p.1). See the National Audubon Bulletin, "Trees are History Books."

## BARK

Choose fairly smooth-barked trees like beech, birch, cherry or young ash. Hold a sheet of paper about the weight of typewriter paper over a section of bark and rub with the side of a soft pencil or crayon. The bark pattern comes out clearly with these trees, but you might experiment with others too: sycamore, pine, or ironwood if you can find it. Mount and label you work.

## LEAF

Choose a leaf with clearly defined veins for a starter. Place leaf on a hard, smooth surface such as a finished plank or a sheet of window glass. Place a sheet of paper over it and proceed as in above.

(Adapted from the Curious Naturalist, Vol. III, No. 6, February, 1964)

STUMP DETECTING (Use Oak)

1. How long ago was this tree felled? Days? Months? Years?
2. What kind of tree was it? Hardwood? Softwood? Healthy?
3. Why was it cut down?
4. What tools were used? Sharp? Dull?
5. Where did the chopper stand? The sawyer? Right Handed? Left Handed? Was he skilled? Unskilled? Did he have helpers?
6. Which way did the tree fall?
7. Was this the intended direction? Why? Why not?
8. Did it fall to the ground or become a "widow maker"? What does widow maker mean?
9. How old was the tree when it was felled?
10. Was its growth consistent? Why or why not?
11. Was its growth symmetrical? If not, why not?
12. Are there signs of disease?
13. Fire?
14. Competition from other plants?
15. Parasites?
16. Do you see signs of decay? What are they?
17. A tree grows a ring of bark for every ring of wood. Why isn't the bark as thick as the wood?
18. How do you account for the fact that the outside of the bark is cracked open?
19. The rings with larger holes grew in the spring; the more dense ones in the summer. Did your tree grow more in spring or summer? Why?
20. Look for "rays" (silvery lines running from center toward bark). What could their purpose be?

(Adapted from William G. Vinal and Kenneth V. Pike)

# OUTDOOR EDUCATION

## DESCRIBING PINE AND FIR - ELEMENTARY

Try to make comparisons for each of the things you carefully inspect. What does each thing remind you of? What do unusual parts of those things look like?

Answer each of the questions below that you can:

1. Tear off a pine needle. Roll it between your fingers and thumb. It rolls like a pencil. Why? _____. How many sides does the pine needle have? _____. Roll a fir needle between your thumb and finger. Why doesn't it roll? _____.

   Which needles grow together in clusters? _____. Which needles grow directly out from the branch as single needles? _____. Which needles are longer? _____. What tool or instrument does the pine needle look like? _____. Do pine needles look like something to sweep the floor? What? _____. Why? _____. Which needles have sharper points? _____. Look closely at the fir needle. What does it remind you of? _____.

2. Set the bark of pine and fir in front of you so you can see both at once. Which bark reminds you of a turtle shell? _____. Which has lines or cracks that run horizontally or sideways? _____. Which has a smoother surface? _____. What does the bark of pine look like that you see around mud puddles when the sun comes out after rain? _____. What does the pine bark most remind you of? _____. What does the underside of the fir bark feel like? _____.

What does the spotty coloring on undersides of the fir bark remind you of? _____. What does the top of the bark remind you of? _____. What does the side of the bark remind you of? _____. What do you see taken from the oven that looks like a side view of fir bark? _____. What makes it look that way? _____.

3. Look at both cones. Hold them up before you. On the small fir cone what do the things sticking out remind you of? _____. How about the big pine cone? _____. What do these same things sticking out remind you of? _____. What does the overall shape of the big pine cone look like? _____. What does the overall shape and size of the small fir cone remind you of? _____.

4. Set the pictures of both the pine and fir before you so you can see both as once. Which is shaped more like a pyramid or a Christmas tree? _____. Do the needles of the pine grow above the branch or below? _____. Which tree has more space between the branches? _____. Which tree has branches growing in regular rows that run parallel to the ground? _____.

OUTDOOR EDUCATION

DESCRIBING HEMLOCK AND CEDAR - ELEMENTARY

Try to make comparisons for each of the things you carefully inspect. What does each of the things look like? What do they remind you of? Answer each of the questions below that you can.

1. Pick up the branch of cedar. Run your thumb and finger down the leaves and back up again. What does it feel like? _____. What thing that creeps through the grass looks like the cedar leaves? _____. Do Boy Scouts ever make anything that looks like this? What? _____. Pick up the hemlock branch and tear off a couple of needles. What do they look like? _____.

2. Pick up the bark of cedar. Tear off a couple of chunks. How does it come off? _____. What shape is the piece torn off? _____. Rub your finger over the end of the cedar. What does it feel like? _____. What does the cedar bark look like or feel like? _____. What does the hemlock bark remind you of? _____. What color is the underside of the hemlock bark? _____. What color is the cedar? _____. On the hemlock? _____.

3. Examine the hemlock cone. What does it remind you of? _____. What other thing has the same size and shape of the cone? _____. What color is it? _____. Look carefully at the cedar cone. What does it look like? _____. It is about the size and shape of what? _____. What color is it? _____.

4. Look at the two pictures, one of hemlock and one of cedar. Which one is shaped like the head of a spear or like a bomb? _____. Which one has a droopy top? _____. The droopy top looks like? _____. Which one has a regular shape? _____. Which one has branches that curve up at the ends? _____. Which droops down at the ends? _____.

# MINERAL IDENTIFICATION

Minerals have characteristic physical properties. The most common are:

1. Hardness: Minerals vary greatly in hardness. It is possible to scratch a mineral with the sharp edge of a harder mineral provided enough pressure is applied. Moh's scale of hardness is such that the hardest mineral is number 10 and the softest is number 1. The hardness of some of the common minerals is as follows:

| Hardness | Mineral |
|---|---|
| 1 | Talc |
| 2 | Gypsum |
| 3 | Calcite |
| 4 | Fluorite |
| 5 | Apatite |
| 6 | Orthoclase |
| 7 | Quartz |
| 8 | Topaz |
| 9 | Corundum |
| 10 | Diamond |

The thumb nail scratches number 2. A copper coin scratches and is scratched by number 3. Glass scratches and is scratched by number 5. A knife blade has the hardness of about 5½-6. Keep in mind that impure minerals may vary in hardness.

2. Color: The color of a mineral is due to the light reflecting from the mineral to the eye. Some minerals may have several colors, such as Fuorite, Quartz, Calcite, Orthclase, chert or flint, bauzite and kaolin.

3. Luster: The luster of a mineral depends upon the quality and intensity of the light which is reflected from the surface of the minerals. Many terms are used to describe luster such as, metallic, non-metallic, vitreous (glass), silky, pearly, dull or earthy, resinous, greasy and adamantine (brilliant).

4. Streak: Streak is the color of the mark a mineral makes when it is rubbed across a procelain or streak plate. The streak usually agrees with the color of the mineral, but not always.

5. Cleavage: The tendency that some minerals have to break along smooth planes in definite directions is called cleavage. Some minerals have as many as 6 cleavage planes while other minerals have no cleavage.

6. Fracture: When minerals having no cleavage are broken the break is irregular and is called a fracture.

   A. Some fractures tend to have surfaces that are irregularly curved in or out. A fracture of this type is called a conchoidal.

7. Weight: The specific gravity of a mineral is its weight compared to an equal valume of water. Quartz is considered to have an average specific gravity for minerals.

8. Crystal form: When pure, most minerals will crystallize into definite forms. These forms follow certain geometric arrangements. Crystals are easy to recognize but care should be exerted to not confuse cleavage with crystal forms.

# GEOLOGY

OBJECTIVES:

1. To recognize minerals in everyday products.
2. To recognize differences as to color, shape, composition, weight, and texture.
3. To learn how to group rocks rather than classify.
4. To learn how to group the way in which formed.
5. To learn how fossils are formed
6. To learn how rocks form from one kind to another.
7. To learn where glaciers get their rocks.

PROCEDURE:

I. Uses of minerals in the classroom

   A. Chalk
   B. Blackboard
   C. Bricks
   D. Pencil lead
   E. Glass
   F. Gravelstone
   G. Kitchen Cleanser

II. Collect rocks on way to gully

   A. Color
   B. Shape
   C. Composition
      1. all one material
      2. mixtures
   D. Weight
      1. heavy for size
      2. light for size
   E. Texture
      1. rough
      2. smooth
      3. jagged

III. Group according to way in which formed. Structure determined by first-hand examination

   A. Sedimentary - water formed
   B. Igneous - fire formed
   C. Metamorphic - changed

IV. Glacier in relation to formation of Oregon area

   A. Formation of hills and valleys
   B. Formation of rocks

V. Fossils

A. Define
B. Observe
C. Plaster of Paris Mold

VI. Research Lab

A. Test for acidic or basic
B. Look under microscope at rocks
C. Group according to
   1. hardness
   2. layering
   3. crumbly

EQUIPMENT:

picks
plaster of Paris
Hand lens
Microscope
Acid
Mineral containing products
Rock key
Mineral kit

ACTIVITY:

Make checklist for idea how to identify
Use picks
Make fossil-like mold
Evaluation in Research Lab

The Lorado Taft Field Campus
Northern Illinois University

## COLLECTING INSECTS

A. Making a net.

A wire ring to which the net is attached should be strong and springy. The bag itself must be durable yet permit the contents to be seen easily. Mosquito netting is not desirable since it wears out quickly. Bobbinet or Bruxelle cloth is preferable since it is inexpensive and wears well. The size of the mesh will be determined by the type of insect to be captured.

The shape and size of the bag are important. The net bag must be long enough so that when an insect is captured the specimen may be kept in the bag by turning the handle and folding the net across the wire-ring. The length of the net should be approximately three times the diameter of the wire ring. The bottom of the net should not taper to a point, but should not be less than 2 or 3 inches in diameter.

B. Making a killing jar for insects.

A simple killing jar may be made using a jar and fingernail polish remover. Killing jars using potassium cyanide or carbon tetrachloride should never be used with children as they are far too dangerous!

C. Mounting Insects.

Line a large flat box (peach crate is good) with corrugated cardboard and cover it with plain wallpaper or construction paper. Fasten small insects to the box by thrusting a pin vertically through the body and into the corrugated paper. (If necessary to keep the insects through the summer, a tight jar will keep the moths out.)

D. Drying and stretching large moths and butterflies.

As soon as the moth or butterfly is killed in the jar, remove it and stretch the wings as follows:

Cut a piece of corrugated cardboard 12" x 12". On it place two one inch piles of corrugated cardboard pieces 12" x 5½", leaving a groove of one inch between them. Fasten the body of the butterfly or moth in the groove and with the point of a pin arrange the wings as desired. Fasten them in place with pins, placed along the marginal ribs of the wings. When well-dried, pin the insect in the mounting box.

# NATURE PICTURE

**Materials:**

Grasses, dried
Corn, Shucks and kernels
Sand
Pebbles
Twigs, various sizes and colors
Seeds
Other dried materials
Cardboard
String or cordage
Glue
Poster paint, any desired color

**Tools:**

Knife

**Directions:**

1. Cut a piece of cardboard to the desired "picture" size.

2. Paint on it a solid background color or spatter paint the background.

3. Place the materials mentioned above on the dry painted background so that they will form a picture or perhaps merely an interesting arrangement. When the arrangement is satisfactory glue the materials to the cardboard.

4. Cut dry branches a few inches longer than the length of each side of the cardboard.

5. Lash them together to make a frame for the picture.

7. Tie the ends of a piece of string to two corners of the frame so it may be hung on the wall.

**Variations:**

1. Paint clouds, sky, and lakes and then fill in trees, buildings, paths, and rocks by gluing dried nature materials on this painted background.

2.

2. If you have a cardboard box a 3-D type of picture can be made much in the same way as in (1) above.

# WEATHER EXPLORATION

Goal: To acquaint the student with some weather factors, ways of measuring such factors, and various pertinent learning techniques.

Purposes:

To Help the student discover some of the components of weather.

To develop some simple weather instruments useful in measuring weather.

To acquaint the student with some involvement teaching techniques.

I. Visit the weather station to introduce the students to the instruments we have available for their use.

A. What are some of the parts of the weather?

1. Define the following as completely as possible:

a. Wind -

b. Pressure -

c. Humidity -

d. Clouds -

B. On the basis of your above definitions and observations, try making some simple instruments that will measure the above components of weather.

1. Wind vane - feather in cork or cardboard vane.

2. Bottle with balloon and pointer.

3. Weat and dry bulb thermomenters.

4. Beaufort scale for wind speed.

II. What are some of the considerations necessary in making a weather prediction?

A. Consult "Forecasting"

III. Establish a list of the facts you can observe about the weather at this moment.

A. On the basis of these facts, what do you think is likely to happen weatherwise in the next 12 hours?

11/9/65
Lorado Taft Field Campus
Northern Illinois University

## WEATHER FORECASTING INFORMATION

Each group of observers forecasts the weather using its own observations in conjunction with preceding reports. Forecasts are based on the following rules and information in various reference books:

1. A falling barometer indicates an approaching "low" with a storm.

2. A rising barometer indicates the passing of the "low" and the approach of a "high" and fair weather.

3. The passing of a "low" in summer will be followed by warmer weather.

4. The passing of a "low" in winter will be followed by colder weather, perhaps with a "cold front" blowing from the "Far North" and with blizzards in regions east of the Far West.

5. Winds from the south or southeast foretell a "low" coming from the west with its center to the north of the observer, and with rain to come witnin 24 hours or sooner.

6. Winds from the east or northeast foretell a "low" coming from the west with its center to the west or to the south of the observer, usually with heavy, chilly rain, and cold weather.

7. Winds swinging from the southeast to the southwest indicate that the center of the "low" has passed to the east of the observer and that fair and colder weather will soon follow.

8. Winds swinging from the east or northeast to the northwest also indicate that the center of the "low" has passed to the east of the observer and that fair and colder weather will soon follow.

9. Cirrus and cirro-stratus clouds, coming from the west with a gray sky, indicate the approach of a "low" with a storm.

10. A bright blue sky with cirrus wisps and with the wind in the west or northwest will be followed by fair weather for 24 to 48 hours or longer.

11. A bright blue sky with numerous cumulus clouds may be followed by stratocumulus and rain or snow flurries during the middle of the day and early afternoon, but fair at sundown.

12. Calm, humid, warm to hot days during the sping may be expected to produce thunder storms.

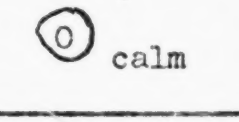
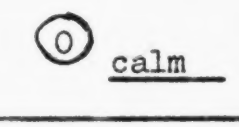
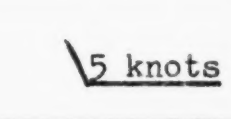
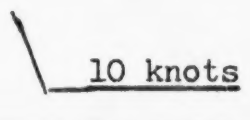
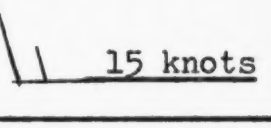
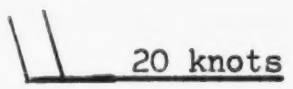
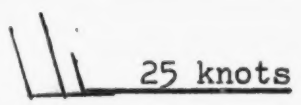
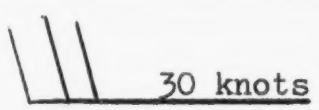
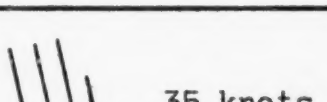
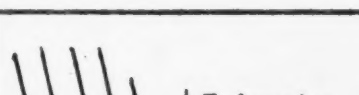
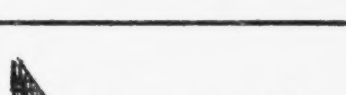
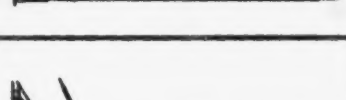
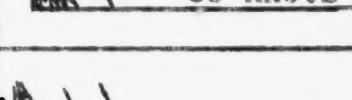
13. If the lightning of a thunderstorm appears to the northwest, west, or southwest, the thunderstorm will come nearer the observer and perhaps pass overhead.

14. If in fall or spring the temperature falls at the end of a clear, calm day to 40 or 45 degrees Fahrenheit, one may expect frost in all low places by morning.

15. Frost will not form under the conditions above if clouds cover the sky before the morning or if a wind of any sort blows during the night.

16. Dew will form every night if there is no wind and the sky is clear so that ground heat may be radiated to space.

# BEAUFORT SCALE - WIND ESTIMATION

| Beaufort number | mph / knots | Description | Observation | Weather Map Symbols |
|---|---|---|---|---|
| 0 | 0-1 / 0-1 | calm | smoke rises vertically |  |
| 1 | 1-3 / 1-3 | light air | smoke drifts slowly |  |
| 2 | 4-7 / 4-6 | slight breeze | leaves rustle |  |
| 3 | 8-12 / 7-10 | gentle breeze | leaves and twigs in motion |  |
| 4 | 13-18 / 11-16 | moderate breeze | small branches move |  |
| 5 | 19-24 / 17-21 | fresh breeze | small trees sway |  |
| 6 | 25-31 / 22-27 | strong breeze | large branches sway |  |
| 7 | 32-33 / 28-33 | moderate gale | whole trees in motion |  |
| 8 | 39-46 / 34-40 | fresh gale | twigs break off trees |  |
| 9 | 47-54 / 41-47 | moderate gale | branches break |  |
| 10 | 55-63 / 48-55 | whole gale | trees snap and are blown down |  |
| 11 | 64-72 / 56-63 | storm | widespread damage |  |
| 12 | 73-82 / 64-71 | hurricane | extreme damage |  |

## WEATHER INFORMATION (Weather Instruments)

| TIME | BAROMETER | HYGROMETER | WIND VELOCITY | TEMP. | WIND DIR. |
|---|---|---|---|---|---|
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |

## ENVIRONMENTAL DATA

| Place | Soil Temp. | Soil Moist. | Air Temp. | Wind Vel. | Plant Life |
|---|---|---|---|---|---|
| Prairie | ——— | ——— | ——— | ——— | ——— |
| River | ——— | ——— | ——— | ——— | ——— |
| Delta | ——— | ——— | ——— | ——— | ——— |
| North Slope (Top) | ——— | ——— | ——— | ——— | ——— |
| North Slope (Mid) | ——— | ——— | ——— | ——— | ——— |
| Gully | ——— | ——— | ——— | ——— | ——— |
| South Slope (Mid) | ——— | ——— | ——— | ——— | ——— |
| South Slope (Top) | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |
| ——— | ——— | ——— | ——— | ——— | ——— |

# FORECASTING

Look for a change to fair weather when:

The barometer rises rapidly.

Clouds appear to break up and clear patches of sky show.

The wind shifts to a westerly or northwesterly direction, indicating passage of a cold front.

Bases of clouds increase in elevation

Look for continuing fair weather when:

The barometer remains steady or rises.

Temperature is normal

Stratus clouds or fog dissipate in the morning.

The wind continues to blow from a westerly direction.

The sun sets clear.

There is dew or frost at night.

Look for colder weather when:

The wind shifts to the west or northwest.

A cold front has passed.

A westerly wind drops in velocity at night and the sun sets clear.

The pressure rises.

Clouds break up after a storm and the northern sky seems to have a greenish tinge (in winter).

Look for warmer weather when:

It is cloudy at night.

A northwest wind has become calm and later begins to blow from the south.

A warm front has passed.

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Excerpted from "WEATHERCASTING" Charles and Ruth Laird, Prentice-Hall Inc. Englewood Cliffs, N.J., 1955.

11/11/65

# EXPERIMENTS WITH WATER

Understandings to be developed or reinforced:

Some determinant factors of the different types of aquatic life are:

a. current velocity
b. water temperature
c. water turbidity
d. water hardness
e. oxygen content of water
f. soil temperature
g. ph of water (acid or base)
h. depth of water
i. air temperature
j. depth of silt and mud

Skills to be developed or reinforced:

Computation of feet to miles, computation of seconds to hours, use of thermometer, use of stop watch, use of yardstick or tape line, use of chemicals.

Tests or Problems relative to study of Aquatic Life:

1. Current (water) velocity
   Place a ping pong ball in the water several feet from the shore line. Measure the distance it travels in 30 seconds. (Use the stop watch) Translate into m.p.h. (Do in the open water).

2. Water temperature
   Place a thermometer into water at depth of 15 cm.

3. Water Turbidity - Using both hands to hold the ends of a short string, lower your arms into the water until you can no longer see the string.

4. Water Hardness
   a. Put 25 nl. of water in a flask.
   b. To the 25nl. sample put 3 drops of soap solution into the flask and shake vigorously after putting the stopper on the flask.
   c. Add additional drops of soap until a lather remains after shaking. Determine hardness from table below:

| No. of drops | Hardness |
|---|---|
| 0-5 | very soft |
| 5-10 | medium |
| 10-15 | very hard |

5. Oxygen Content of Water
   a. Put 100 nl. of water in a flask.
   b. Add 10 drops of Mn So4 solution to sample of water.
   c. Add 10 drops of KOH 4KI solution to sample of water.
   d. Put top on bottle and mix with only 3 wrist motions.
   e. Wait 1 minute. Take off top and add 15 drops of concentrated H2SO4
   f. Results to be noted:
      1) If only a trace of oxygen is present, the solution turns yellow.
      2) If oxygen is abundant, the solution turns bright yellow.
      3) If no oxygen is presnt, the water remains clear.
6. Air Temperature - take temperature just above the water.
7. Soil Temperature - Take temperature along water's edge.
8. Ph of water (acid or base) Test with paper. Use chart to determine result.
9. Depth of water - use stick and measure height of water level.
10. Depth of silt and mud before hitting the rock bed.

From: Lorado Taft Field Campus
Northern Illinois University

# SIMPLE MACHINES: OUT-OF-DOORS

Level: Grade one or later

Objectives: To provide experience using simple machines such as levers, block and tackle, inclined planes, etc.

To provide example out-of-doors activities for any grade level

To assist teachers to develop their concepts and appreciations of simple machines, input and output, work, distance and force.

To discover activities usable in the teaching of "simple machines" in outdoor settings.

Materials and apparatus:

Poles, planks, lots of rope, pulleys and blocks, round posts, heavy objects, well setup, etc.

Activities: Discover or develop as many activities as possible to aid students to inductively arrive at generalizations about simple machines. Then do or try out these activities.

Examples:
1. Remove a person trapped beneath a fallen tree.
2. Move the butt of a fallen tree away from the stump.
3. Move a heavy object (car) a distance of several feet.
4. Move a heavy object (log) a long distance.
5. Lift an object heavier than yourself higher than your head.
6. Lift a heavy bucket of water from the well.
7.
8.
9.

Analysis: These activities may be of minimal value if no analysis is made of the mechanical laws being used.

Primary level: Allow pupils to examine apparatus and arrive at their own methods to accomplish the necessary work.

Intermediate Level: Carry the analysis so that relationships can be seen between the methods or machines used (in most cases a lever is involved), the relationship between input and output.

Upper level: Extend the analysis to the actual measurement of the forces and work done.

DISCUSSION ITEMS:

1. Types of levers - what are the three general types and the conditions under which each serves best?
2. What is the relationship between distance and force? What distance was each force exerted compared to the distance the load was moved? What are product moments? How can these be measured?

3. In a block and tackle arrangement - what effect does variation in the number of pulleys being used have?

4. Is the windlass an adaptation of a lever? or levers? What about the pulley?

5. What effect does friction have on the relationship between the amount of effort expended and work accomplished?

ACTIVITY EXAMPLE - Levers:

A fallen tree too heavy to life must be moved. Using a pole or pry bar and a block (fulcrum) discover as many ways as you can to raise or move the tree.

After a discovery period - analyze the methods through which you had success. Note the relationships between the tree (load), block (fulcrum), and direction of your effort (force).

Sketch these relationships.

Once we understand the relationships between load, fulcrum, and effort move the log by using these types of levers, but each time vary the relative distance between the load, fulcrum, and effort. What are your results?

Advanced students may carry this to the computation of the product moments.

March 1966
The Lorado Taft Field Campus
Northern Illinois University

# Suggested Activities for Language Arts

## LANGUAGE ARTS

Write or tell a humorous story of life from the point of view of an animal or insect.

"Smell and Tell"- Describe the smell of a wet or dry day.

Use figures of speech to describe the out-of-doors such as alliteration, simile, metaphor, hyperbole, or onomatopoeia.

Choose something which at first appears to be ugly or not particularly beautiful. Describe the object again after looking at it carefully.

Write about seasonal changes that might occur in your immediate location. Try to imagine what your immediate location will be like in ten, fifty, or one hundred years.

Write a story about a miniture world as magnified through a hand lens.

Make a nature picture using objects or things found in the surrounding areas. Tell about it.

Suggested questions to write about:

1. What would be a good adventure for you today?
2. What picture flashes in your mind when you hear the word "Happy"?
3. When and where have you found beauty in silence?
4. What is a friendly sound by day? By night?
5. What smell do you like to smell best?
6. What have you touched which made you wonder?

Outdoor Education Workshop
Southern Illinois University

OUTDOOR EDUCATION

Elementary Language Arts: Fifth or Sixth Grade

Descriptive Writing

Goals: Develop an understanding of unity
Develop an understanding of the need for details in description.
Develop powers of observation

Materials: Bird or mammal collection from the University of Washington Burke Museum. (Call I.M.C. Mrs. Donna Lauch will arrange to have the collection delivered to your school.)

Activities:

1. Make a model paragraph, using the observations offered by students in class discussion. Construct the model paragraph on the blackboard.

   A. With either collection start by displaying before the class a specimen with very unusual features. To have the students themselves draw an opinion which they will be able to support with description, ask the class a question such as the following: Do you think this bird looks very different from other birds: (Yes!) Can we say that he looks entirely different from other birds? (No!) What can we say? (The _____ looks different from other birds in many ways?) Really, many ways? Let's check!

   B. Have students pick out the specimen's unusual features. Then make a simple outline to make sure that all of the birds features have been considered: Body shape; body size; color, markings, stripes; beak shape; beak size; claws. (See student writing specimen.)

   C. As the teacher is writing the students suggestions on the board in constructing the model paragraph, the students should be copying the model paragraph on their own papers.

2. Give each student a specimen and announce the following assigment : (For best results, jot the assignment on the board.)

   A. Look carefully at "your bird (mammal)" to see if it has many or only a few unusual features. (Check for color; markings, like spots and stripes; unusual shaped head or beak.

# DESCRIPTIVE WRITING

Directions: Find the objects listed below and then do the following things with each object: (1) look at the object (2) feel the object (3) smell the object (4) listen for sounds which may come from it (or are associated with it (5) taste it (if it is safe to do so). IN THE SPACE PROVIDED AFTER EACH OBJECT WRITE AS MANY DESCRIPTIVE WORDS ABOUT THE OBJECT AS YOU CAN USING YOUR SENSORY EXPERIENCES AS THE BASIS FOR DESCRIPTION. FURTHER, DESCRIBE IN WRITING THE AREA WHERE YOU FOUND THE OBJECT.

1. This year's deciduous leaf -

2. This year's evergreen leaf -

3. Last year's deciduous leaf -

4. river water -

5. water from the spring -

6. wet soil along the river -

7. a rock -

8. twig on a tree -

9. a flower -

10. bark on a tree -

Descriptive Writing

Activities:

B. Write one descriptive paragraph (follow model) on "your bird." Your first sentence should say either (1) The (name of specimen) looks different from other birds in many ways. OR (2) The _____ looks different from other birds in only a few ways.

(See student writing specimens)

ALPHABET OBSERVATION HIKE

Purpose: To help the individual become aware of native materials found in the outdoors through direct observation.

Procedure: Divide into small groups and have each group list as many natural items as they can find beginning with each letter of the alphabet.

| Plant | Animal | Mineral |
|---|---|---|
| A. | A. | A. |
| B. | B. | B. |
| C. | C. | C. |
| D. | D. | D. |
| E. | E. | E. |
| F. | F. | F. |
| G. | G. | G. |
| H. | H. | H. |
| I. | I. | I. |
| J. | J. | J. |
| K. | K. | K. |
| L. | L. | L. |
| M. | M. | M. |
| N. | N. | N. |
| O. | O. | O. |
| P. | P. | P. |
| Q. | Q. | Q. |
| R. | R. | R. |
| S. | S. | S. |
| T. | T. | T. |
| U. | U. | U. |
| V. | V. | V. |
| W. | W. | W. |
| X. | X. | X. |
| Y. | Y. | Y. |
| Z. | Z. | Z. |

Language Arts Exercise - Continued

V. Give pupils pine samples. Check the notes on the fir to see if the things said about the fir can also be said about the pine. If so, we have to look for something more specific, or unusual and concrete.

Make a simple outline on board:

| | Fir | Pine |
|---|---|---|
| Bark | _____ | _____ |
| Leaves | _____ | _____ |
| Cone | _____ | _____ |

Now ask pupils to suggest what we could put in each blank that would be an identifying characteristic. (Look for something special in the fir bark that doesn't show up in the pine bark. Do the same for the leaves and cone.)

Final Assignment:

Write a brief description of pine in one paragraph and fir in a second paragraph, using the best identifying characteristics suggested.

# OUTDOOR EDUCATION

Language Arts Exercise - Noting Identifying Characteristics and Selecting Specific Details.

Goal: Understanding need for specific, concrete, unique characteristics in identifying one particular thing from another when both are in same broad category.

I. Discuss what makes it possible for us to identify one person from another or one house from another when really most people and houses look alike. (Other topics to discuss: balls, cars, animals)

Example:

What makes it easy for us to identify a beaver: (tail like a slab of smooth tire rubber.)

What makes it easy for us to tell a football from other balls? (oval shape) or a tennis racket from a ping pong paddle? (Size, plus Strings on the hitting area of the tennis racket) of Johnny from other boys in the class (front teeth missing, freckles, etc.)

II. After defining what constitutes identifying characteristics, tell pupils that they will be given three items taken from a fir tree to help identify the fir from other trees which look like a fir. Explain that these three items can also be taken from many other evergreen trees. Ask pupils to note what they think is special about these items that might help us recognize what tree they came from. Have pupils note one thing about each item.

III. Give pupils the following from a fir:

| Item | Possible Identifying Features |
|---|---|
| 1. Chip of bark | Marbling of chocolate & vanilla layer, ridges, rough texture. |
| 2. Bough or twig with foliage | Short flat needles, blade-like, sprout from all sides of branch. |
| 3. Cone | Small, egg shape, bracts or "pitch-forks" between plates or shells. |

IV. Place on blackboard:

Consider:

1. Overall shape
2. Texture
3. Color (watch for unusual markings or patterns.)

# Suggested Activities for Mathematics

## ARITHMETIC

## 6TH GRADE

## GROWTH IN ARITHMETIC

| Understandings | Outdoor Experiences |
|---|---|
| 1. The average of several numbers is always less than the largest number and always larger than the smaller number. | 1. Lay-out a plot of ground - have students measure the diameter of ten trees of different sizes and determine the average diameter of the trees measured. |
| 2. The distance around a rectangle is its perimeter. | 2. Students work the following problem by laying-out a plot of ground 82' x 18'. How many feet of rope are needed to enclose a rectangle 82 feet by 18 feet to be used for pitching horseshoes?. |
| 3. What is the size of an acre? What does it look like? How can you lay-out an acre of ground? With what are you acquainted that is almost the same size as an acre? | 3. Have students lay-out an acre (square) on the school playground (210' on each side).<br><br>Have students lay-out a rectangular shaped acre on the school playground (229' long and 190' wide).<br><br>Have students make a list of any vacant lots, fields, parking areas, lawns, or other playgrounds in the neighborhood which they think contain about an acre of ground. By measuring these areas their approximations can be verified. |

## ARITHMETIC PROBLEMS

Understandings to be developed or reinforced: arithmetic average, board beet, diameter, area, economic value of trees, Biltmore stick, Merritt rule, clinometer, angles.

Skills to be developed or reinforced: computational, use of Biltmore stick, use of Merritt rule, use of clinometer

Problem: In the plot of ground enclosed by string, there are ten (10) trees. Using the Biltmore stick to measure diameter of the trees and Merritt rule to approximate the volume of trees (board feet), solve the following problems:

a. What is the average diameter of the 10 trees?

b. What is the total number of board feet in the 10 trees?

c. What is the economic value of each of the 10 trees, if the lumber is valued at 16 cents per board feet?

d. What is the area of the plot of ground enclosed by string?

e. What is the average height of the 10 trees?

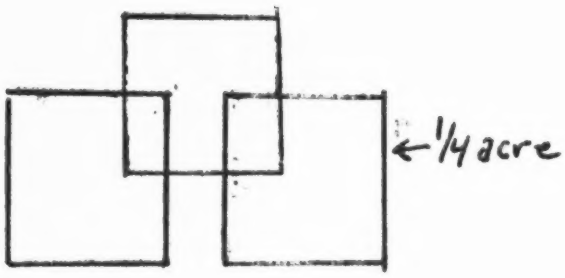
- - - - - - - - - - - - - - - - - - -

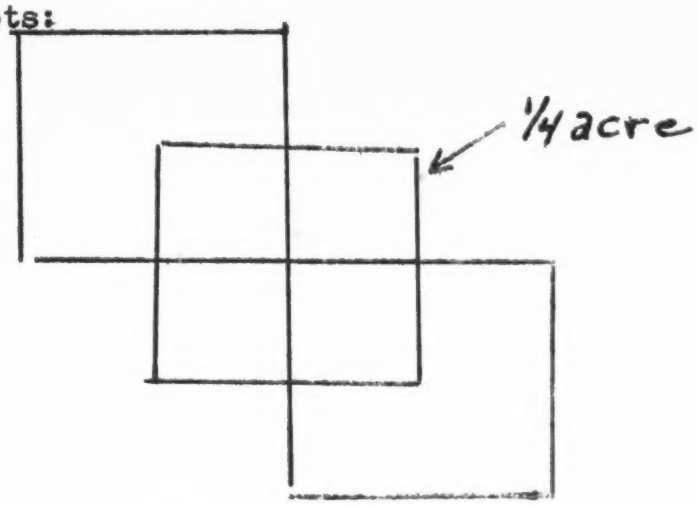
Understandings to be developed or reinforced: compassing, intersecting lines, parts of an acre, scaled mapping, physical land marks, numerical ratio

Skills to be developed or reinforced: use of the compass

Problem: Using string and the compass, lay-out (in the park area) three (3) intersecting one-fourth (¼) acre plots of ground. Draw a scaled map (¼ inch = 20 feet), showing location of any physical land marks (including trees, etc.).

Examples of intersecting plots:



# UTILIZATION OF GEOMETRIC PRINCIPLES IN MAP CONSTRUCTION

INTRODUCTION: Constructing maps of the school area may clarify children's concepts of maps and the areas they represent, and provide direct experiences with mathematical principles. The procedure below is sufficiently simple to be used with intermediate grade children.

These outcomes may be expected: (1) a "scale map" will be constructed, (2) Practice is provided using non-standard measuring units and instruments, (3) concepts of "scale" may be clarified, (4) application is made of "similar triangle" relationships, (5) the geometric principle "if the three sides of a triangle are fixed or of a given length, the shape of the triangle cannot be altered" is utilized.

Materials needed: (1) An area to be mapped, (2) Map or drawing paper placed on a heavy cardboard sheet, (3) Magnetic compass, (4) Marking compass, and (5) Protractor. For a first attempt, the area to be mapped might be about fifty feet square and contain a few trees to be positioned on the map. Older students may wish to map considerable larger and more complex sites.

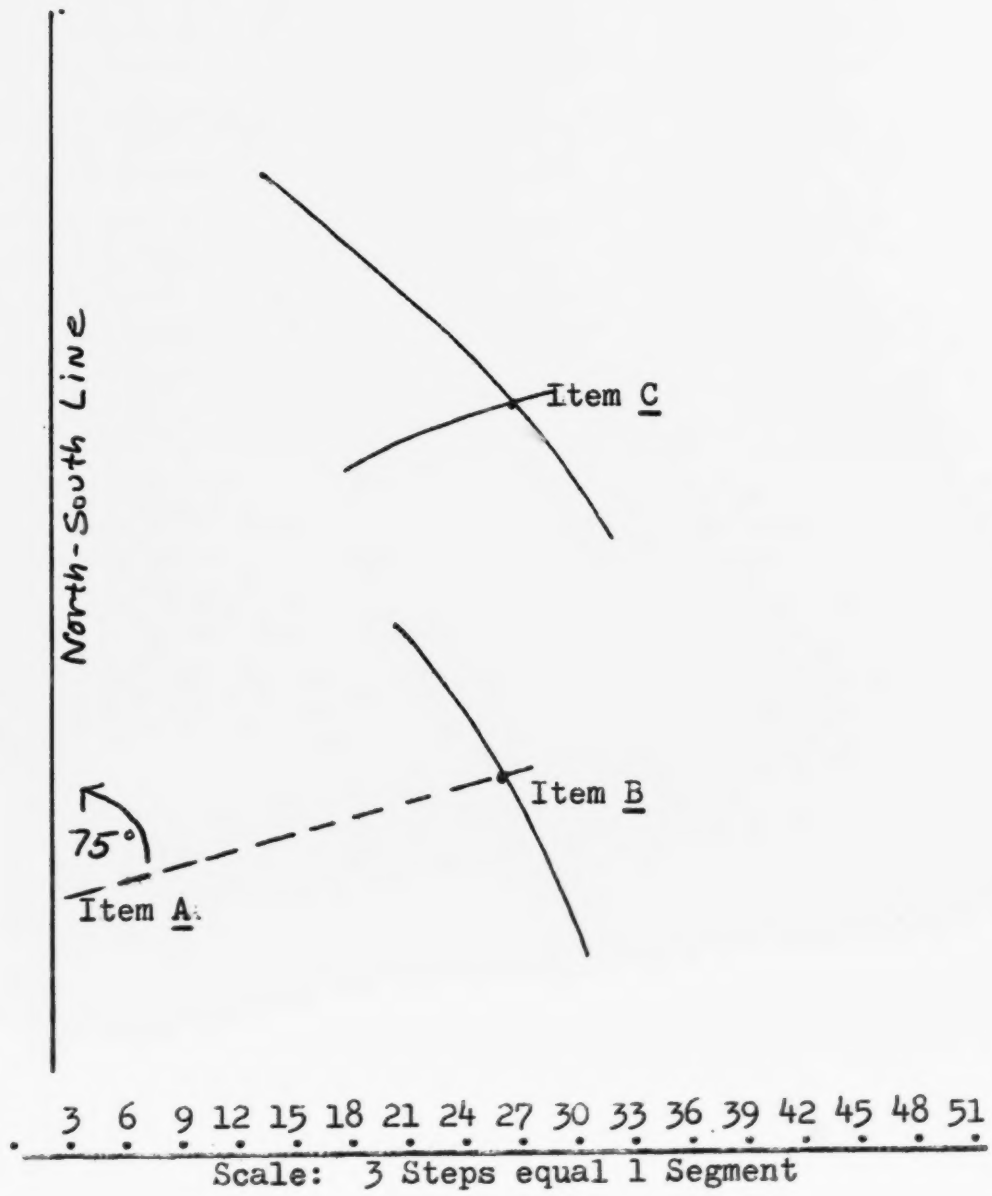
PROCEDURE:

1. Your "step-length" is a convenient unit of measure for this exercise. Count the steps along the width and length of the area to be mapped.
2. Draw a line the full width of your map paper about one inch from the bottom. Divide this into equal segments of about ¼ to ½ inch in length This is your scale line.
3. Upon determining the size of the map you wish to construct you can arrive at the scale to be used expressed in "steps" per "segment" of your scale line. For example, you might use a scale in which three steps equal one segment on your scale line.
4. Position on your map one item of the area to be mapped (Point A).
5. The second item (B) to be placed on your map is related to item A in distance and direction. To determine distance (1) count the "steps" between items A and B, (2) spread the marking compass this distance on the scale line, and (3) draw an arc of this radius with point A at the center. Point B is located at one point on this arc.
6. Lightly draw a North-South line parallel to the side of your paper through point A. Using a magnetic compass determine the azimuth from item A to item B. With your protractor locate the exact position of B on your map.
7. Since two items (A and B) have been established on your map, no additional directional measurements are needed when positioning other items. Why?
8. To locate C, a third item (1) step-off the distance between A and C, (2) spread the marking compass this distance on the scale line, and (3) draw an arc with A as the center. Repeat for the distance between B and C. Point C lies at the intersection of these arcs.
9. Repeat "8" above to located the other items to be placed on your map. It is not necessary to always return to A and B to locate these additional items. Why? Can any two of the items previously positioned in your map serve as reference points.

NOTE: The following page consists of an example map illustrating the above procedure.

May 1966
Lorado Taft Field Campus
Northern Illinois University

EXAMPLE OF PROCEDURE




Notes: Item B is 24 steps distant from A and at an azimuth of 75 degrees.

Item C is 36 steps from A and 21 steps from B

The position of additional items can be determined by utilizing any two of the positions A, B, C, or any other pair of previously fixed items as reference points.

# Suggested Actities for Social Studies

## SOCIAL STUDIES

Observe the odor or smoke in the atmosphere near an industrial plant. What are the economic activities that contribute to air pollution.

Observe industrial pollutants that are difficult to dispose of or disperse. Questions to ask - What are the views of industry on pollution? Does the State allow certain permissible views of pollution. Write to the public relations department of a major industry for information on their control of pollution.

Examine old farm sites to determine what type of people lived there at various times. Observe old buildings, figure how they were constructed. Explore for artifacts which might provide clues of how people lived.

Discuss the problems of early settlement. Visit an abandoned settlement, and determine why an early settler would choose that parcicular location for a homesite. Dramatize some phase of pioneer living - clearing of land, house-raising, gathering and hunting, and fishing.

Go on a field trip to locate old landmarks - Make a physical and cultural survey of the area.

Look for devices of plants and animals that parallel man's inventions. Example - What insect uses fans for cooling? (Bees use their wings to cool the hive.)

Elizabeth Roller
Outdoor Education Workshop
Southern Illinois University

Hug and Wilson
Curriculum Enrichment Outdoors.

TEACHER'S SAMPLE

ACTIVITY FORM

DATE _____ TIME INVOLVED _____ DISTANCE TRAVELED _____

SUBJECT AREA _____

OBJECTIVES _____

_____

_____

Things To Do - (this is in preparation for the out-of-doors as well as during the activity)

A.

B.

C.

D.

Things To Observe - (multi-sensory approach)

A.

B.

C.

D.

Necessary Personal Items and Equipment (i.e. heavy clothing for ice caves, climbing shoes, Silva Compasses, etc.)

A.

B.

C.

D.

Evaluation - Remarks

A.

B.

C.

D.